SUPERIOR SATELLITE ENGINEERS
1743 MIDDLE ROAD
COLUMBIA FALLS, MT 59912
406-257-9590 FAX 406-257-9599

TO: RSI 5M
Manual

Models 500CS and 500KS

Radiation Systems, Inc.

SatCom Technologies Division

5.0-Meter Satellite Earth Station Antenna

Features

- Qualified for 2° satellite spacing
- Prime focus feed
- Lightweight
- Low cost
- Easy to install
- Optional motorized drives

Description

The Model 500CS (C-Band) and 500KS (Ku-Band) are economical, high performance antennas designed for use with video, message and data networks. They meet FCC radiation pattern requirements for operation at 2° satellite spacing. They also meet current Intelsat and Eutelsat radiation pattern specifications.

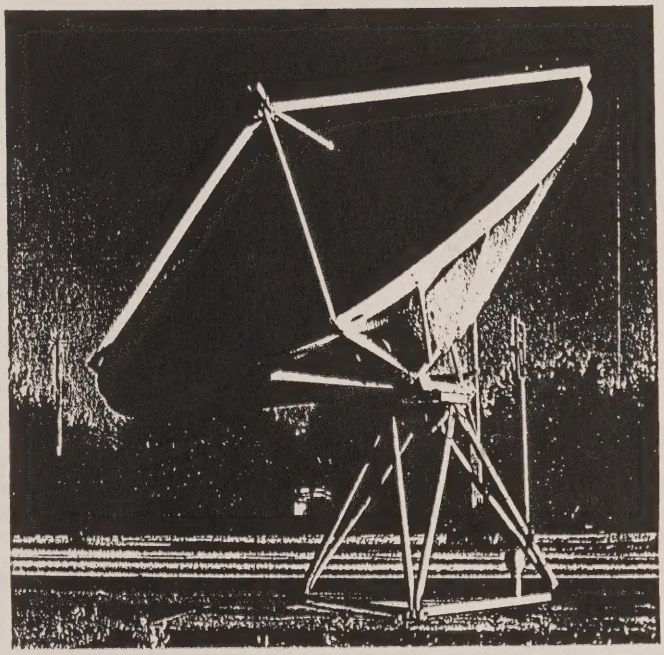
Superior RF performance is achieved through the use of twenty-four precision AccuShape® reflector panels and a prime focus feed. The high strength aluminum reflector panels are supported by an identical number of lightweight trusses. All panels are completely interchangeable. A mounting plate interfaces the trusses to the mount. No alignment or testing of the reflector during installation is necessary.

The feed is a corrugated ground plane aperture which yields circularly symmetrical illumination characteristics. Additionally, the design provides excellent cross polarization isolation performance. The standard Ku-Band feed is capable of dual receive or receive/transmit output configurations. Optional diplexer assemblies can convert this feed to a 3-port. (2-Rx, 1-Tx) or 4-port (2-Rx, 2-Tx) configuration. The feed is supported by a guadrapod spar configuration for optimum secondary pattern control.

The galvanized steel mount employs a straightforward elevation-over-azimuth geometry to allow easy pointing to any visible satellite within the orbital arc. A margin of safety has been built into the design to ensure antenna support under adverse environmental conditions. The mount's stiff, rugged construction provides the pointing accuracy needed for either C-Band or Ku-Band operation.

The tripod mount design allows for easy installation on three concrete piers. Each pier is typically 18" diameter and 8' deep. Only about two cubic yards of concrete are needed. The antenna is insensitive to foundation heading due to its ability to be pointed 360° in azimuth.

Optional motorized actuators are used for the elevation and azimuth axes and a polarization drive unit rotates the feed. These drive options can be added to a manual antenna in the field. The optional Series 4000 microprocessor-based programmable control system is capable of positioning the antenna to within .02° accuracy. In the manual mode, it allows an operator to run or jog each axis while monitoring the position on a video terminal. In the automatic mode, it can store up to 40 satellite positions and automatically direct the antenna to any position according to a preprogrammed schedule. Options are available for program track and for controlling other earth station components.



*AccuShape® is a precision metal contouring process proprietary to Radiation Systems, Inc.

Options

- Motorized 3-axis drives
- Deicing systems
- Feeds with the following polarizations:

C-Band	Ku-Band
Receive Only	Receive Only
Single linear	Single linear
Dual linear	Dual linear
Dual circular	
Receiver/Transmit	Receive/Transmit
Orthogonal linear	Orthogonal linear
Circular	3-port frequency reuse
	4-port frequency reuse

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Specifications — Models 500CS and 500KS

Electrical

	C-Band Model 500CS (With Linear Receive/Transmit Feed)		Ku-Band Model 500KS (With Linear Receive/Transmit Feed)		
	Receive	**Transmit**	**Receive[1]**	**Receive[1]**	**Transmit**
Frequency	3.7-4.2 GHz	5.925-6.425 GHz	10.95-11.2 GHz	11.7-12.2 GHz	14.0-14.5 GHz
Gain (Midband)	44.3 dBi	47.4 dBi	52.9 dBi	53.6 dBi	55.0 dBi
VSWR	1.30:1	1.30:1	1.30:1	1.30:1	1.30:1
Beamwidth					
- 3dB	1.05°	0.68°	0.37°	0.34°	0.29°
-15 dB	2.10°	1.36°	0.75°	0.70°	0.60°
First Sidelobe Level	-14 dB	-14 dB	-14 dB	-14 dB	-14 dB
Radiation Pattern[2]	Meets current FCC specifications		Meets current FCC, Intelsat and Eutelsat specifications		
Antenna Noise Temperature (ref. omt port), Typical Elevation					
10°	43 K		38 K	38 K	
20°	33 K		28 K	28 K	
30°	27 K		25 K	25 K	
Power Handling Capability		5kW CW			2kW CW
Cross-Pol Isolation					
On-Axis	35 dB	35 dB	35 dB	35 dB	35 dB
Off-Axis	30 dB	30 dB	30 dB	30 dB	30 dB
Feed Port Isolation					
RX/RX	35 dB			35 dB	
TX/RX	35 dB			35 dB	

[1]Choose one receive band. Other bands and special wideband feeds are available.
[2]Radiation distribution envelopes are available upon request.

Mechanical

Antenna Diameter	5.0 Meters	Antenna Travel Rate (Motorized Options)	
Antenna Type	Prime Focus	Azimuth	
Reflector Construction	24 panels, AccuShape®	Standard Speed	0.5°/sec.
Mount Type	Elevation-over-azimuth	Low Speed	0.1°/sec.
Antenna Travel		Elevation	
Elevation	0° to 80° continuous	Standard Speed	0.5°/sec.
		Low Speed	0.1°/sec.
Azimuth	360° gross adjustment		
Manual	360° continuous	Polarization	
Motorized	180° continuous sectors	Standard Speed	1.0°/sec.
Polarization Adjustment			
Manual	360°	Weight	
		Net	1500 lbs.
Feed Interface	Model 500CS	Model 500 KS	Shipping 2000 lbs.
Receive	CPR229G	WR75	Shipping Volume 300 ft.[3]
Transmit	CPR137G	WR75	

Environmental

Wind Loading at 32°F	
Operational	30 mph gusting to 45 mph
Degraded Operation	60 mph gusting to 85 mph
Survival[1]	110 mph, no ice - 87 mph with 1" radial ice
Pointing Accuracy	
30 mph wind gusting to 45 mph	.030°rms
45 mph wind gusting to 65 mph	.060°rms
Temperature Range	
Operational or Survival[1]	-40°F to 125°
Atmospheric Conditions	Salt, pollutants and corrosive contaminants as found in coastal and industrial areas.

[1]Survival conditions for wind and temperature considered separately.

All specifications are subject to change without notice.

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Satellite Antenna Systems Engineering Excellence

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INSTRUCTION MANUAL

HI-NET SATELLITE ANTENNA

Provided by:
Radiation Systems, Incorporated
1501 Moran Road
Sterling, Virginia 22170

May 1986

SAFETY NOTICE

The attention of installation, operating, and maintenance personnel is directed to the subject of safety precautions to be observed. Personnel must observe safety regulations at all times. Maintenance personnel shall become familiar with the technique for resuscitation found in manuals of first aid instructions. The following are general safety precautions that personnel must apply during many phases of operation and maintenance.

WARNING

THIS EQUIPMENT EMPLOYS RF VOLTAGES WHICH MAY CAUSE HARM IF EXPOSURE TO THEM IS PROLONGED AND ACCUMULATIVE. DO NOT PROCEED IN FRONT OF THE ANTENNA WHENEVER IT IS RADIATING.

KEEP AWAY FROM LIVE CIRCUITS

OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY REGULATIONS. DO NOT REPLACE COMPONENTS OR MAKE REPAIRS OR ADJUSTMENTS WITH RADIO FREQUENCY OR ELECTRICAL POWER APPLIED TO THE ANTENNA.

DO NOT SERVICE OR ADJUST ALONE

UNDER NO CIRCUMSTANCES SHOULD ANY PERSON REPLACE COMPONENTS OR MAKE REPAIR OR ADJUSTMENTS EXCEPT IN THE PRESENCE OF SOMEONE WHO IS CAPABLE OF RENDERING AID.

RESUSCITATION

PERSONNEL WORKING WITH OR NEAR ELECTRICAL CIRCUITS SHOULD BE FAMILIAR WITH MODERN METHODS OF RESUSCITATION.

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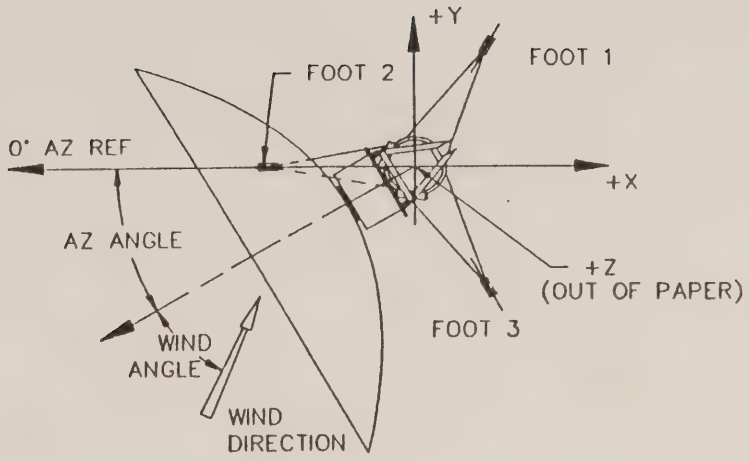


Foundation Loading: Sign Conventions

NOTE

The following tables list forces which are the loads applied to the foundation by the antenna. The 31.0 psf (110 mph) load cases include the corresponding Antenna Weight Only loads. Forces are in lbs; moments are in lb-ft.

Table 3-2. Loads at Individual Antenna Feet

LOAD CASE	ANT AZ	WIND DIR	EL ANGL	FOOT 1 Fx	FOOT 1 Fy	FOOT 1 Fz	FOOT 2 Fx	FOOT 2 Fy	FOOT 2 Fz	FOOT 3 Fx	FOOT 3 Fy	FOOT 3 Fz
WEIGHT ONLY	0	0	0	374	-39	-211	-746	-1	-1147	372	39	-213
WEIGHT ONLY	0	0	60	265	149	-381	-530	-1	-807	264	-148	-382
WEIGHT ONLY	0	0	90	189	281	-502	-377	-0	-567	188	-281	-502
31.0 PSF	0	0	0	1421	2772	-4466	5178	4	7354	1428	-2776	-4458
31.0 PSF	0	0	60	2215	2097	-4095	-585	-2	-1030	2212	-2096	-4099
31.0 PSF	0	0	90	-166	1439	-1756	1275	2	1935	-163	-1441	-1751
31.0 PSF	0	60	0	833	2968	-4281	5562	-524	7907	2155	-2944	-5197
31.0 PSF	0	120	0	1474	-222	-762	-1481	862	-2207	-992	554	1419
31.0 PSF	0	180	0	-380	-2062	2854	-5012	-4	-7269	-388	2067	2844
31.0 PSF	0	180	60	571	-1370	1369	-2671	-4	-4034	565	1374	1361
31.0 PSF	0	180	90	544	-877	752	-2029	-2	-3069	539	879	747
WEIGHT ONLY	36	0	0	138	-89	50	-671	228	-1027	533	-139	-594
WEIGHT ONLY	36	0	60	158	126	-263	-496	104	-753	338	-230	-555
WEIGHT ONLY	36	0	90	172	277	-485	-372	16	-558	200	-293	-528
31.0 PSF	36	0	0	2635	4716	-7719	4126	-102	5846	-267	105	303
31.0 PSF	36	0	60	2144	2886	-4937	-884	584	-1419	1849	-1211	-2868
31.0 PSF	36	0	90	554	1788	-2784	967	-571	1464	-756	-662	-252
31.0 PSF	36	60	0	2209	5198	-8006	4656	-656	6601	346	79	-165
31.0 PSF	36	120	0	892	-890	499	-1788	1145	-2623	-614	125	553
31.0 PSF	36	180	0	-1660	-3548	5645	-4126	466	-5976	1109	-315	-1239
31.0 PSF	36	180	60	-451	-1910	2866	-2220	765	-3342	1429	223	-827
31.0 PSF	36	180	90	-210	-1234	1814	-1711	603	-2560	1156	75	-803
WEIGHT ONLY	60	0	0	-19	-39	103	-550	339	-833	568	-300	-840
WEIGHT ONLY	60	0	60	87	148	-240	-441	155	-664	354	-302	-667
WEIGHT ONLY	60	0	90	162	280	-482	-364	24	-545	203	-304	-544
31.0 PSF	60	0	0	2940	5099	-8393	2419	-156	3408	-1345	2009	3415
31.0 PSF	60	0	60	1857	3203	-5116	-1368	865	-2048	1432	-741	-2060
31.0 PSF	60	0	90	976	1709	-2994	465	-850	702	-969	-41	721
31.0 PSF	60	60	0	2613	5734	-8946	2934	-729	4138	-840	2150	3237
31.0 PSF	60	120	0	509	-1196	1160	-1687	1300	-2452	-357	-372	-279
31.0 PSF	60	180	0	-2149	-3739	6221	-2688	696	-3887	1946	-1963	-3904
31.0 PSF	60	180	60	-1036	-1817	3171	-1486	1168	-2225	1754	-680	-2249
31.0 PSF	60	180	90	-653	-1150	2031	-1194	897	-1791	1374	-567	-1810

Table 3-3. Total Loads on Foundation

LOAD CASE	ANT AZ	WIND DIR	EL ANGL	---FOUNDATION FORCE AND MOMENT SUMMATION--- Fx	Fy	Fz	Mx	My	Mz
WEIGHT ONLY	0	0	0	-0	-0	-1571	-0	-4654	-0
WEIGHT ONLY	0	0	60	-0	-0	-1571	-0	-2113	-0
WEIGHT ONLY	0	0	90	0	0	-1571	-0	-317	-0
31.0 PSF	0	0	0	8027	-0	-1570	-0	54317	-0
31.0 PSF	0	0	60	3842	-0	-9224	-0	13151	-0
31.0 PSF	0	0	90	946	0	-1571	-0	17846	0
31.0 PSF	0	60	0	8550	-500	-1571	3672	58152	8807
31.0 PSF	0	120	0	-999	1195	-1571	-8780	-11992	-14836
31.0 PSF	0	180	0	-5781	0	-1571	-0	-47121	-0
31.0 PSF	0	180	60	-1535	0	-1303	-0	-25999	-0
31.0 PSF	0	180	90	-946	-0	-1570	-0	-18479	-0
WEIGHT ONLY	36	0	0	-0	0	-1571	2736	-3765	-0
WEIGHT ONLY	36	0	60	-0	0	-1571	1242	-1709	-0
WEIGHT ONLY	36	0	90	-0	0	-1571	186	-256	0
31.0 PSF	36	0	0	6494	4718	-1570	-31927	43943	0
31.0 PSF	36	0	60	3108	2258	-9224	-7730	10640	0
31.0 PSF	36	0	90	765	556	-1571	-10490	14438	0
31.0 PSF	36	60	0	7211	4621	-1571	-31210	49205	8807
31.0 PSF	36	120	0	-1511	380	-1571	-54	-14862	-14836
31.0 PSF	36	180	0	-4677	-3398	-1571	27697	-38121	-0
31.0 PSF	36	180	60	-1241	-902	-1303	15282	-21034	-0
31.0 PSF	36	180	90	-765	-556	-1570	10862	-14950	-0
WEIGHT ONLY	60	0	0	-0	-0	-1571	4031	-2327	-0
WEIGHT ONLY	60	0	60	-0	-0	-1571	1830	-1056	-0
WEIGHT ONLY	60	0	90	-0	0	-1571	274	-158	0
31.0 PSF	60	0	0	4014	6952	-1570	-47040	27158	-0
31.0 PSF	60	0	60	1921	3327	-9224	-11390	6576	-0
31.0 PSF	60	0	90	473	819	-1571	-15455	8923	0
31.0 PSF	60	60	0	4708	7154	-1571	-48525	32256	8807
31.0 PSF	60	120	0	-1534	-268	-1571	5996	-13599	-14836
31.0 PSF	60	180	0	-2890	-5006	-1571	40808	-23560	0
31.0 PSF	60	180	60	-767	-1329	-1303	22516	-12999	-0
31.0 PSF	60	180	90	-473	-819	-1570	16003	-9240	-0

CHAPTER 1
INTRODUCTION

1-1. SCOPE. This technical manual provides information and instructions for assembly, installation, operation and maintenance of the Hi-Net Satellite Antenna, hereafter referred to as the Hi-Net antenna. This antenna provides a receive only satellite communications capability. Optional equipment is available to permit transmitting signals.

1-2. PURPOSE OF EQUIPMENT. The Hi-Net antenna is used to receive microwave radio frequency (rf) energy in a satellite communications system. It is designed to receive in the frequency range of 11.7 to 12.2 GHz.

1-3. DESCRIPTION OF EQUIPMENT. As a major component of a complete satellite communications system, the Hi-Net antenna is a permanently mounted 5-meter parabolic antenna. Figure 1-1 identifies the major assemblies of the Hi-Net antenna.

1-4. FUNCTION OF EQUIPMENT. The Hi-Net antenna consists of a 5-meter reflector with feed attached to an adjustable mount. The reflector is used to receive Ku-band satellite communications. The feed system consists of a scalar horn and a two port OMT (Orthogonal Mode Transducer). The antenna mount permits a wide range of elevation and azimuth adjustments. The major components of the antenna function as follows:

a) **The Feed System**

The feed system permits rf energy to be received from the communications satellite. This system consists of a scalar horn which offers excellent pattern control and polarization purity and a two-port OMT (Orthogonal Mode Transducer).

b) **The Reflector Assembly**

The reflector consists of the following major components, (1) center plates, (2) trusses and (3) panels:

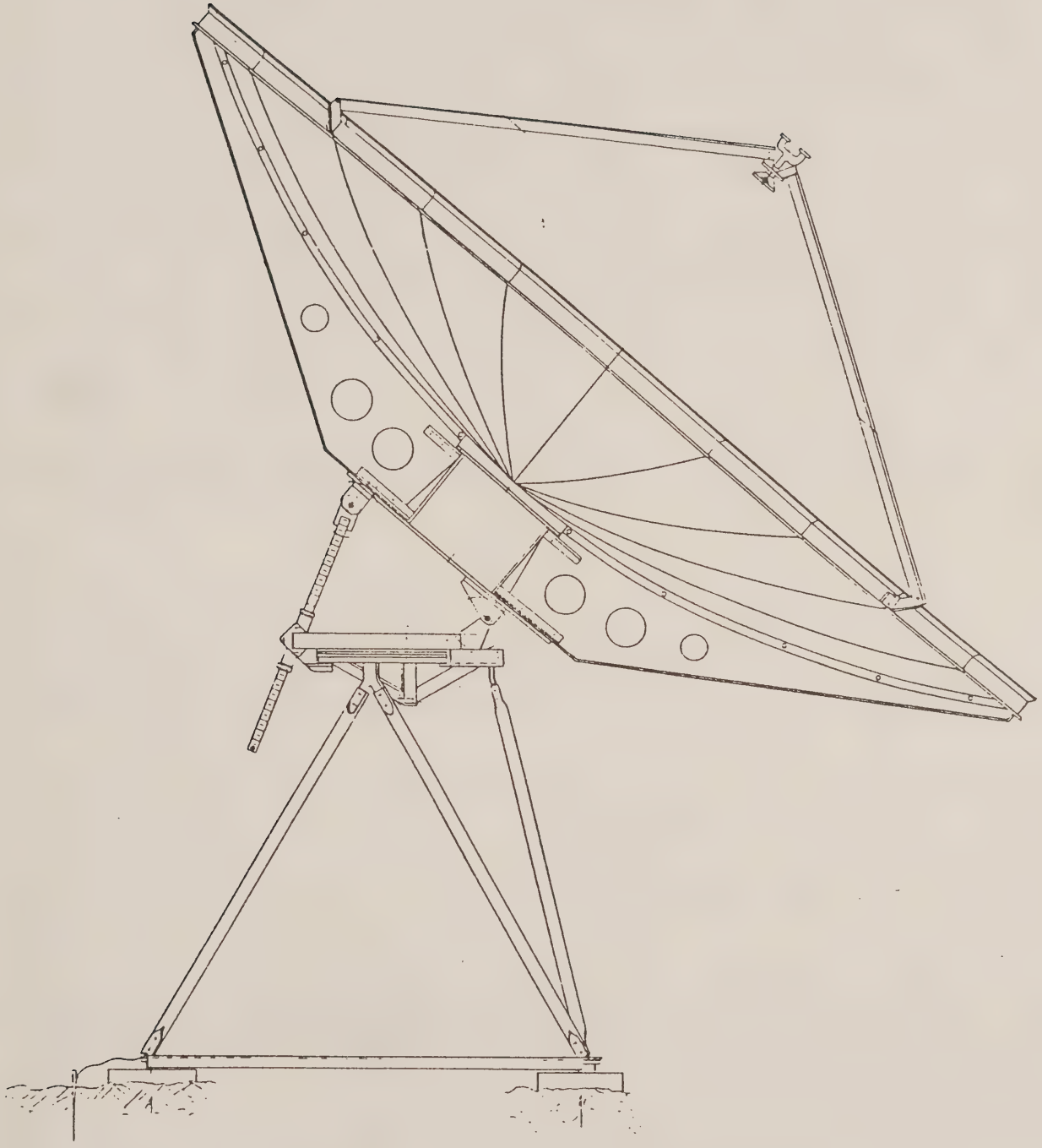


Figure 1-1. Hi-Net Satellite Antenna

1. **The center plates** are the central parts of the reflector to which all major structural members are attached. There is an upper, middle and lower plate along with a vertex plate.
2. **The trusses (24)** are connected to the upper and lower plates and are used to support the 24 panels.
3. **The panels (24)** make up the reflector surface. Each panel is identical and completely interchangeable.

c) **The Antenna Mount**

The elevation-over-azimuth mount supports the reflector and permits wide-ranging adjustments. Elevation adjustments from 5 to 85 degrees can be made, while the base ring on the mount allows a continuous 360 degree azimuth adjustment.

1-5. LEADING PARTICULARS. The leading particulars of the Hi-Net antenna are listed in Table 1-1.

TABLE 1-1. LEADING PARTICULARS

Characteristics	Description
Reflector Weight	800 lbs. (approximate)
Reflector Diameter	5 meters
Antenna Weight	1,650 lbs. (approximate)

1-6. CAPABILITIES AND LIMITATIONS. The capabilities and limitations of the Hi-Net antenna are listed in Table 1-2.

TABLE 1-2. CAPABILITIES AND LIMITATIONS

Capabilities and Limitations	Description
Frequency	11.7 to 12.2 GHz
Gain (11.7 GHz)	53.0 dBi (min.)
Polarization	linear (adjustable through 185°)
Wind	
Operation	30 to 45 mph 60 to 85 mph (degraded)
Survival	125 mph (stow @ 85° elevation)

EQUIPMENT SUPPLIED. Table 1-3 lists the equipment supplied with the Hi-Net antenna along with a brief description of each component. Refer to Figure 1-1 for the location of the components.

TABLE 1-3. EQUIPMENT SUPPLIED

Name	Description
Hi-Net Reflector	A 5-meter parabolic reflector which directs rf energy to the feed. Consists of 24 panels and support structure.
Feed Assembly	A receive only feed consisting of a scalar horn and two port OMT. Receives rf energy from the reflector.
Antenna Mount	Supports the reflector and feed. Permits elevation and azimuth adjustments.
Azimuth Adjuster	Allows fine adjustments of the azimuth setting.

ADDITIONAL TOOLS/EQUIPMENT REQUIRED. Table 1-4 lists the equipment or tools not supplied with the antenna but that are required for installation.

TABLE 1-4. ADDITIONAL TOOLS/EQUIPMENT REQUIRED

Quantity	Description	Purpose
1	Bubble Level	Aids Foundation leveling.
1	Screwdriver, Phillips	Used to install feed.
2	Socket set, 1-1/8", 9/16", 1/2"	Used for hardware attachment on the Mount and Reflector Assemblies.
2	Ratchet, ½" drive	Used with larger sockets.
2	Ratchet, 3/8" drive	Used with smaller sockets.
1	Power Screwdriver	Used to install vertex plate.
2	Air ratchet (optional)	Speeds assembly time.
2	Wrench set, 1 1/8", 9/16", ½"	To secure nuts while attaching hardware.
1	Allen Wrench, 7/64	Used to install LNB to waveguide transition.
AR	Step Ladder/Scaffolding	Used to reach upper assemblies.
1	Compass	Determines azimuth angle.
2	Inclinometer	Determines elevation angle.
1	Crane	Used to lift reflector onto mount.
1	Tape Measure (7')	Used to align feed.
1	Rubber Mallet	Used to tap clips onto reflector edge.
1	Hammer	Used to insert pins into elevation clevises.
1	Masking Tape (Roll)	Used to hold bearing backing plates and bearing pads onto azimuth clamps.
1	Cleanser (Formula 409)	Used to clean reflector components.
1	Grease (Tube)	Used to lubricate reflector components.

CHAPTER 2
ASSEMBLY AND INTEGRATION

SCOPE. This chapter provides instructions to assemble and install the Hi-Net antenna. Section I provides information on the antenna site and foundation. Section II details assembly procedures for the antenna mount. Section III contains assembly procedures for the reflector. Section IV describes the feed system assembly and installation.

SECTION I
SITE AND FOUNDATION PREPARATION

SITE SELECTION. The installation site must be a clear area of approximately 35 feet in diameter. The site should contain no obstructions (natural or artificial) which would prohibit a clear view toward the desired communications satellite. The antenna heading should also be free of nearby noise generating sources such as electrical transmission lines, power generating equipment, radio and radar systems and electronic medical equipment.

FOUNDATION. The foundation should be designed using sound engineering practice for any environment which the antenna is expected to experience. Since the Hi-Net antenna can be rotated through 360 degrees azimuth, precision foundation alignment is not necessary. Typical foundation designs for both pad and pier foundations are shown in Figure 2-1. However, professional assistance is required to ensure that the foundation is designed properly for local conditions and building codes. RSi does not represent or warrant that the foundation designs shown in Figure 2-1 are appropriate for any specific site location.

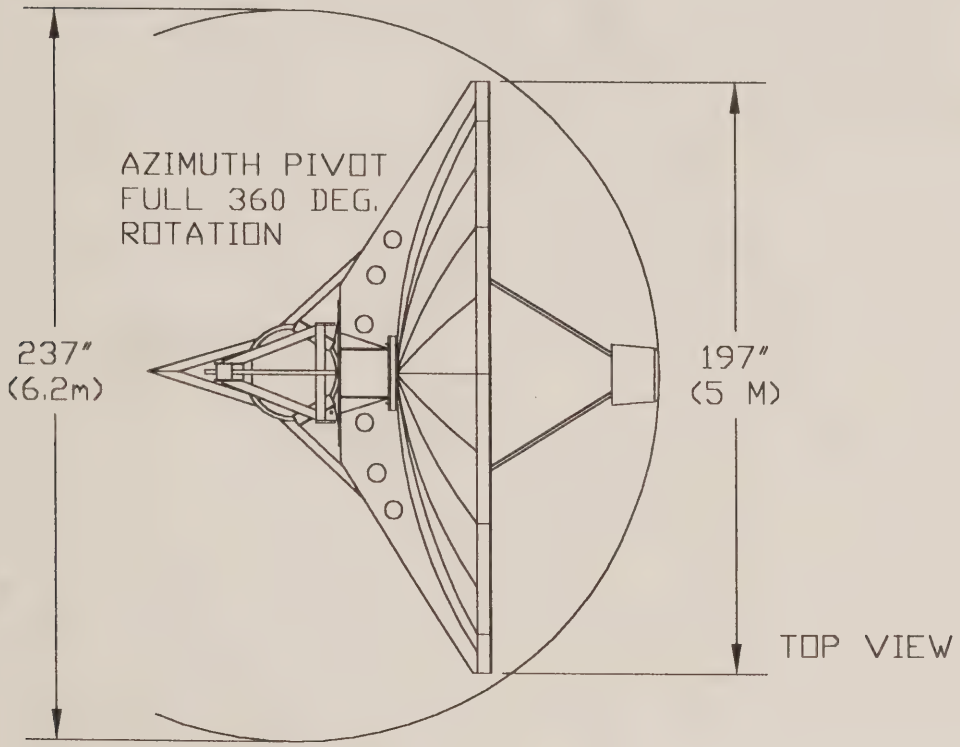
NOTE

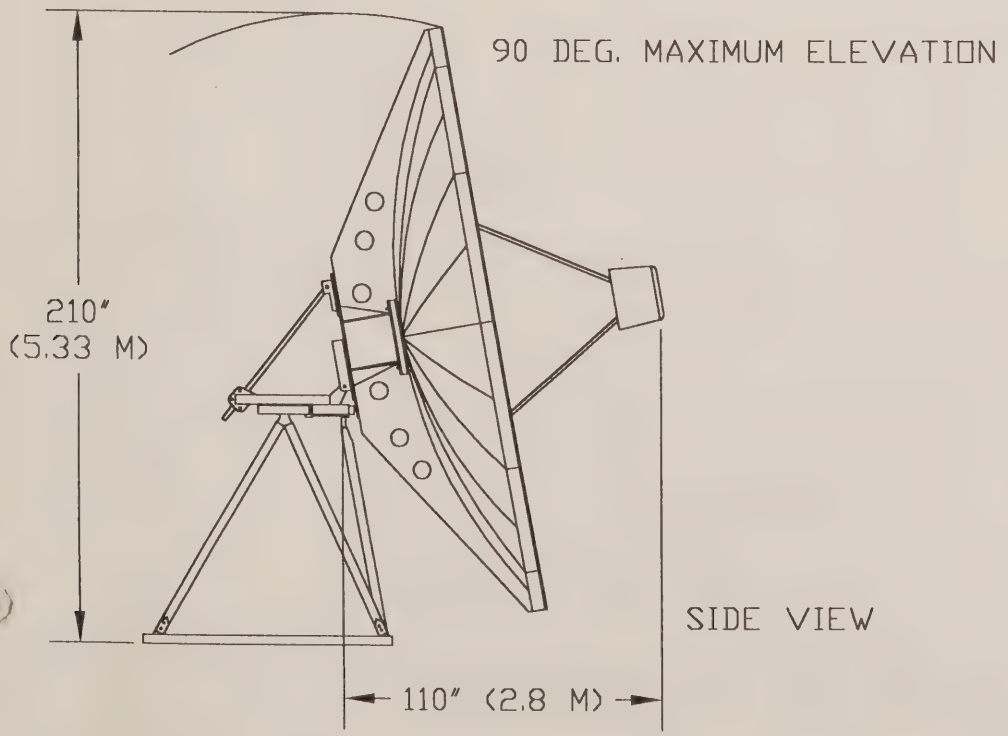
FOUNDATION MUST BE LEVEL. AN OPTIONAL TEMPLATE IS AVAILABLE WHICH ENSURES PROPER ANCHOR BOLT POSITIONING AND LEVELING.

ALLOW PROPER CURE TIME FOR THE CONCRETE FOUNDATION.

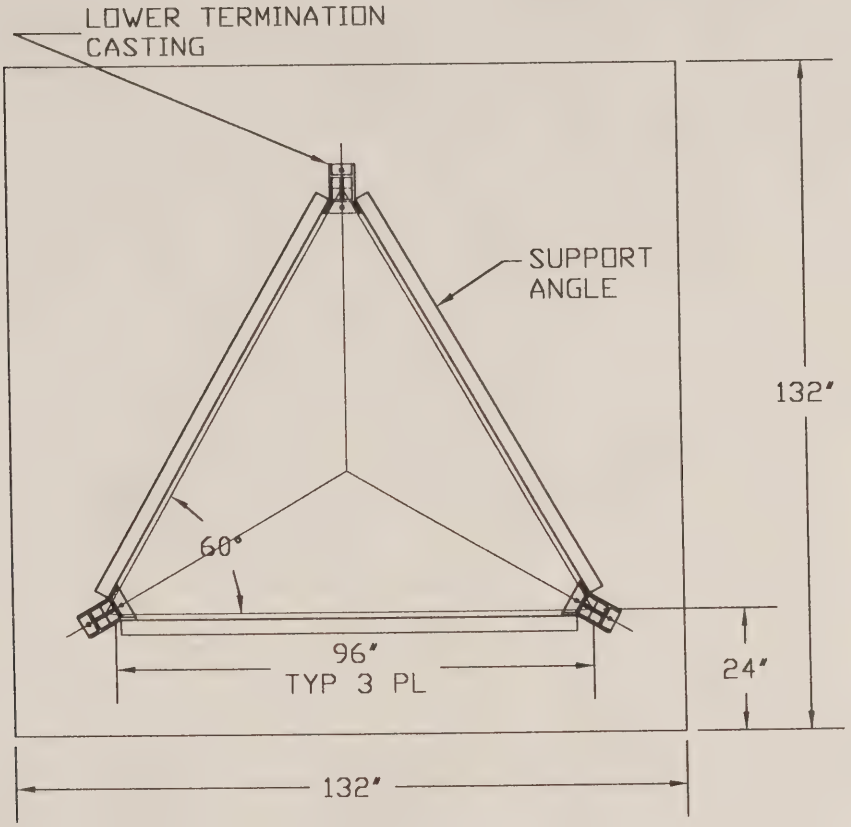
VERIFYING OPERATIONAL CLEARANCE

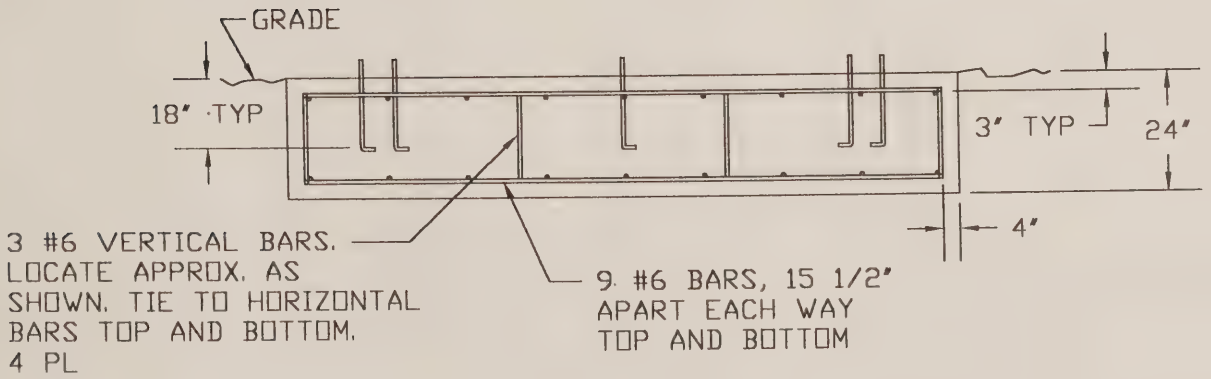
Once the antenna aiming coordinates have been determined, it is necessary to verify operational clearance. This ensures that antenna movement necessary for both aiming and maintenance purposes is not restricted.

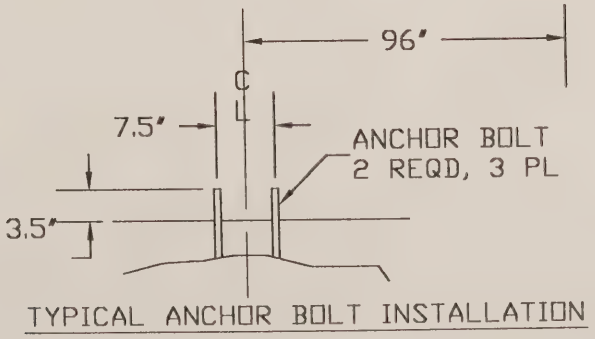




PAD FOUNDATION

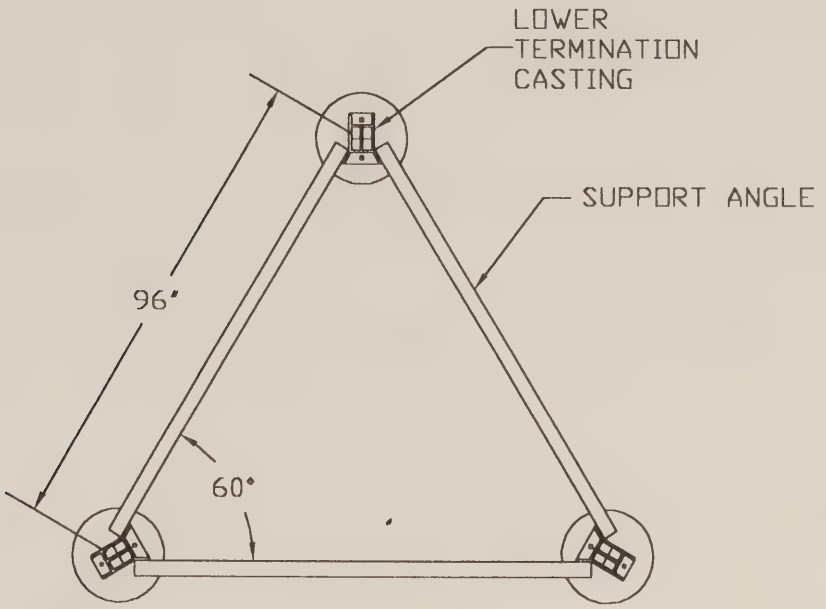


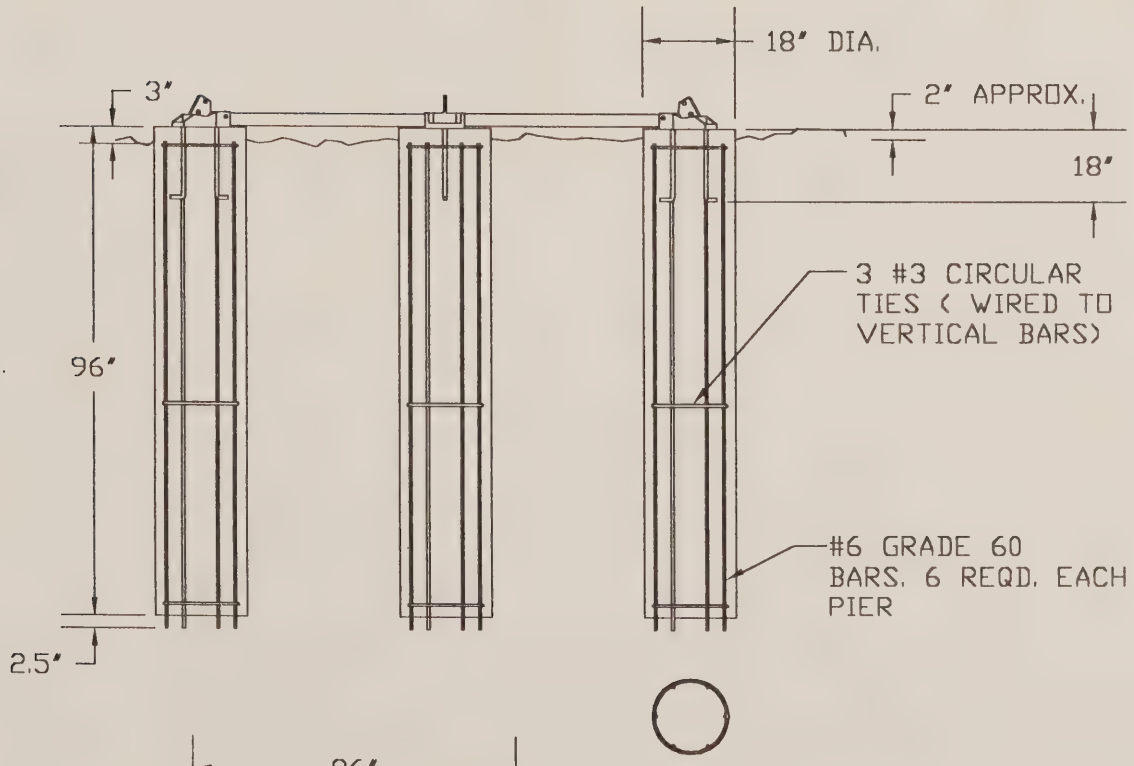


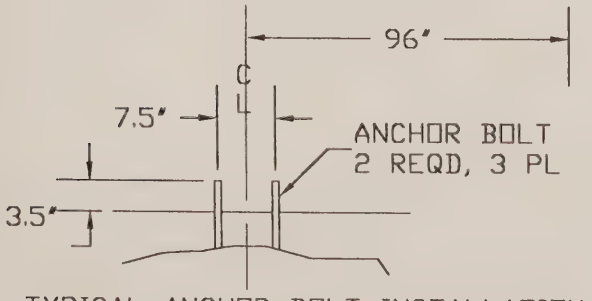


TYPICAL ANCHOR BOLT INSTALLATION

PIER FOUNDATION







TYPICAL ANCHOR BOLT INSTALLATION

SECTION II
ANTENNA MOUNT ASSEMBLY

2-4. LOWER TERMINATION CASTING INSTALLATION. Three lower termination castings (foundation feet) must be attached to the anchor bolts on the foundation. Using Figure 2-2, install as follows:

a) Place each lower termination casting onto the anchor bolts so that the extensions point toward the center of the foundation.

NOTE

LOWER TERMINATION CASTINGS MUST REST FLUSH AGAINST THE FOUNDATION. NO NUTS ARE REQUIRED BETWEEN THE CASTINGS AND THE FOUNDATION.

b) Attach each lower termination casting to the anchor bolts using two each flat washers (13/16 I.D.) and hex nuts (3/4-10). Do not tighten hardware.

2-5. HORIZONTAL ANGLE INSTALLATION. Three horizontal angles are attached between the lower termination castings on the foundation. Using Figure 2-2, install as follows:

a) Position one horizontal angle between two lower termination castings so that the hole on each angle end is aligned with the hole on each casting extension. The top flange on this angle faces inward as shown in Figure 2-2.

b) Attach each horizontal angle to the lower termination casting extensions using two hex head screws (3/4-10 x 1 3/4"), four flat washers (13/16 I.D.) and two hex nuts (3/4-10). The hex head screws must point inward. Do not tighten hardware.

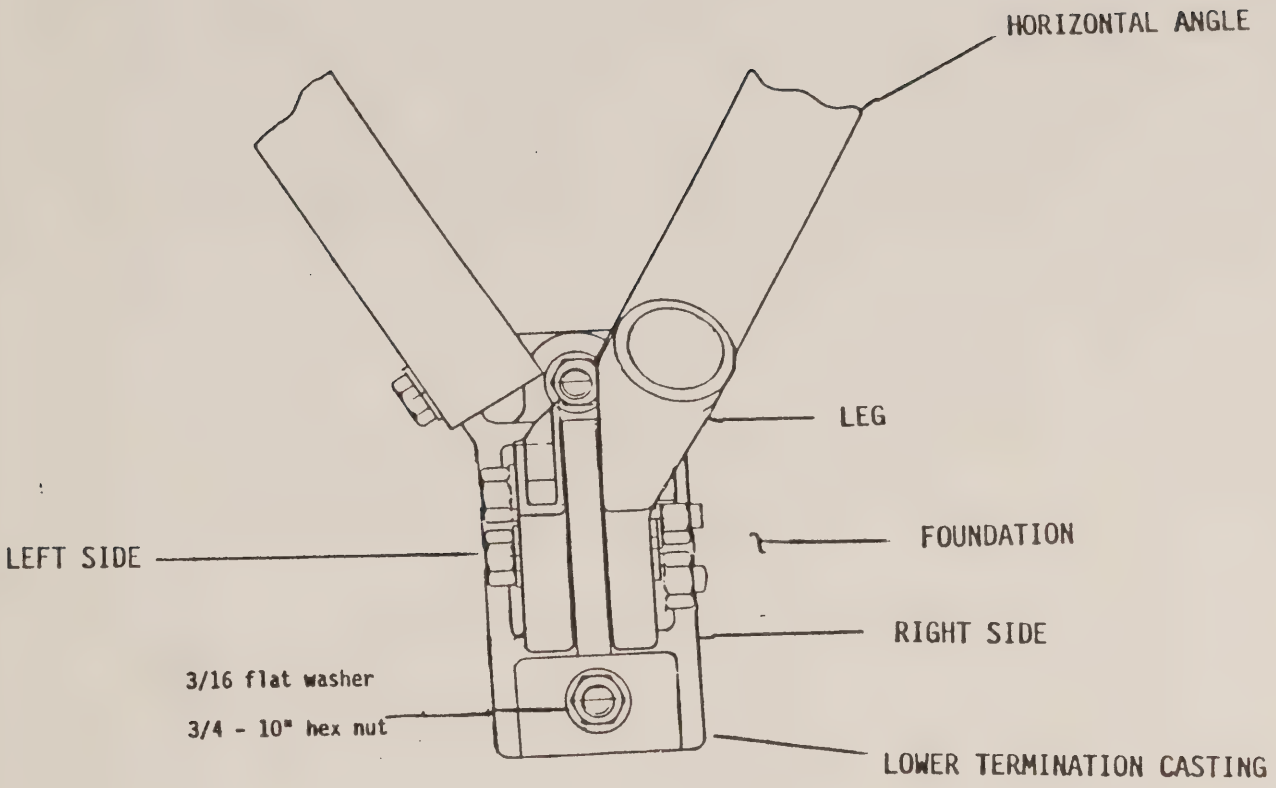
c) Repeat steps a and b for the two remaining horizontal angles.

d) Torque the lower termination casting/anchor bolt connections to 130 ft-lbs.

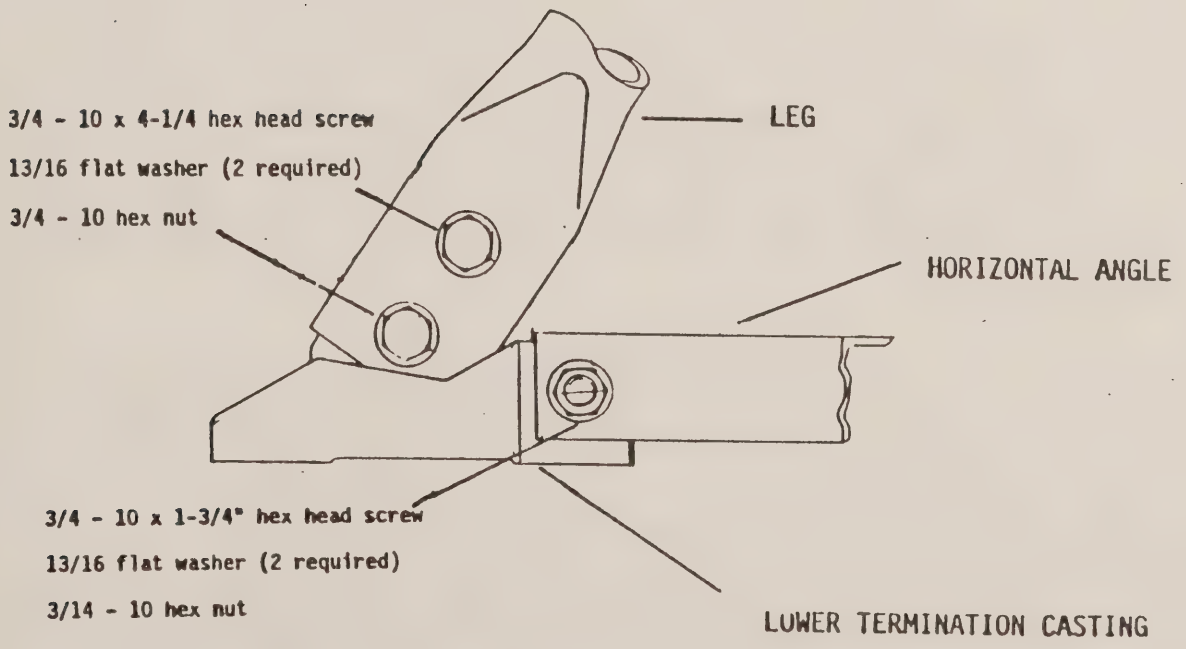
e) Torque the horizontal angle/lower termination casting connections to 130 ft-lbs.

NOTE

ENSURE THAT BASE IS LEVEL.



Top View


3/4 - 10 x 4-1/4 hex head screw
13/16 flat washer (2 required)
3/4 - 10 hex nut
LEG
HORIZONTAL ANGLE
3/4 - 10 x 1-3/4" hex head screw
13/16 flat washer (2 required)
3/14 - 10 hex nut
LOWER TERMINATION CASTING

Side View

Figure 2-2. Lower Mount Attachments

2-6. LEG AND UPPER TERMINATION CASTING INSTALLATION. Six legs (three right and three left) are attached to the three lower and upper termination castings to support the Hi-Net antenna. Using Figures 2-2 and 2-3, install as follows:

NOTE

THE RIGHT LEGS ARE IDENTIFIED BY A RED PAINT MARK ON ONE END. THE LEFT LEGS ARE MARKED WITH YELLOW PAINT.

a) Insert the angled end of one right leg into the right side of the lower termination casting.

b) Insert the angled end of one left leg into the left side of the lower termination casting so that the two legs form a 'V'.

c) Attach the two legs together using two hex head screws (3/4-10x4¼"), four flat washers (13/16 I.D.) and two hex nuts (3/4-10). Do not tighten hardware.

d) Repeat setps **a**, **b** and **c** for the remaining legs.

e) Insert the extension of one upper termination casting into a leg from each adjacent lower termination casting. The upper termination casting must point inward toward the foundation as shown in Figure 2-3. Attach the two legs at each casting using two hex head screws (3/4-10x2¼"), four flat washers (13/16 I.D.) and two hex nuts (3/4-10). Do not tighten hardware.

NOTE

IF NECESSARY, TAP THE UPPER TERMINATION CASTINGS INTO THE LEGS WITH A MALLET.

f) Repeat step **e** for the two remaining upper termination castings.

2-7. TRIANGULAR PLATE INSTALLATION. The triangular plate attaches to the upper termination castings to support the azimuth ring. Using Figure 2-3, install as follows:

a) Place the triangular plate, with flange side down, onto the upper termination castings.

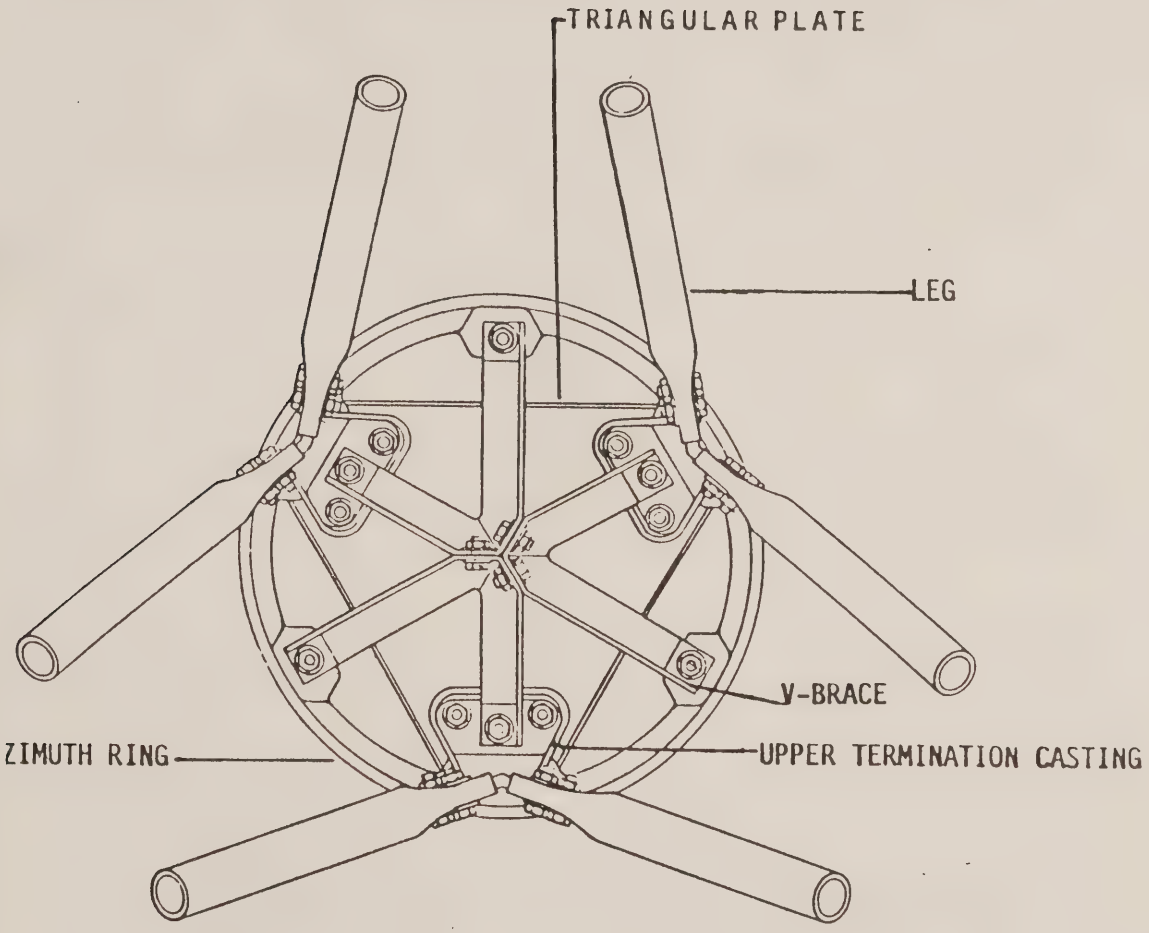
NOTE

ALL HARDWARE IS IDENTICAL

3/4 - 10 x 2-14" hex head screw

13/16 flat washer

3/10 hex nut



NOTE:

TWO OUTER HOLES ON UPPER TERMINATION CASTING NOT SHOWN.

Figure 2-3. Upper Mount Attachments (Bottom View)

b) Align the bolt holes on the triangular plate with the bolt holes on the upper termination castings.

c) Attach the triangular plate to each upper termination casting at the two inner holes on the triangular plate. Use two hex head screws (3/4-10 x 2 1/4"), four flat washers (13/16 I.D.) and two hex nuts (3/4-10) at each of the three locations. The hex head screws must point downward. Do not tighten hardware.

-8. AZIMUTH RING INSTALLATION. The azimuth ring fits over the triangular plate to form a base for the azimuth frame assembly. Using Figure 2-3, install as follows:

a) Place the azimuth ring on top of the triangular plate.

b) Align the bolt holes on the azimuth ring with the bolt holes on the triangular plate.

c) Attach the azimuth ring to the outer holes on the triangular plate and upper termination castings (bolt holes not shown in Figure 2-3). Use two hex head screws (3/4-10 x 1 3/4"), four flat washers (13/16 I.D.) and two hex nuts (3/4-10) at each of the three locations. Do not tighten hardware.

-9. V-BRACE INSTALLATION. Three V-braces are installed beneath the triangular plate to strengthen the mount and to help support the azimuth ring. Using Figure 2-3, install as follows:

a) Before attaching to the triangular plate, align the two holes at the center of each V-brace to each other as shown in Figure 2-3.

b) Attach each V-brace at the center using three hex head screws (3/4-10 x 2 1/4"), six flat washers (13/16 I.D.) and three hex nuts (3/4-10). Do not tighten hardware.

c) Lift the assembly and align the short extension of each V-brace to the center hole on the underside of each upper termination casting.

d) Attach the short extension of each V-brace to the upper termination casting and the triangular plate using one hex head screw (3/4-10 x 2 1/4"), two flat washers (13/16 I.D.) and one hex nut (3/4-10) at each of the three locations. Do not tighten hardware.

e) Attach the long extension of each V-brace to the azimuth ring using one hex head screw (3/4-10 x 2 1/4"), two flat washers (13/16 I.D.) and one hex nut 3/4-10). Do not tighten hardware.

'. TIGHTENING SEQUENCE. Torque all 3/4-inch hardware in steps 2-6 through 2-9 to 130 ft-lbs as follows:

NOTE

IN STEPS A AND B, USE A LEVEL TO ENSURE THAT THE AZIMUTH RING REMAINS LEVEL.

a) Torque the two bolts connecting each pair of legs to the lower termination casting.

b) Torque the two bolts connecting each leg to the upper termination casting.

c) Torque all V-brace hardware to 130 ft-lbs.

d) Torque the two bolts connecting each upper termination casting with the azimuth ring.

e) Torque the two bolts connecting each upper termination casting with the triangular plate.

1. AZIMUTH FRAME ASSEMBLY INSTALLATION. The azimuth frame assembly tracks around the azimuth ring to allow azimuth adjustments. Using Figure 2-4, install as follows:

a) Apply a layer of grease to all the bearing pads and bearing backing plates.

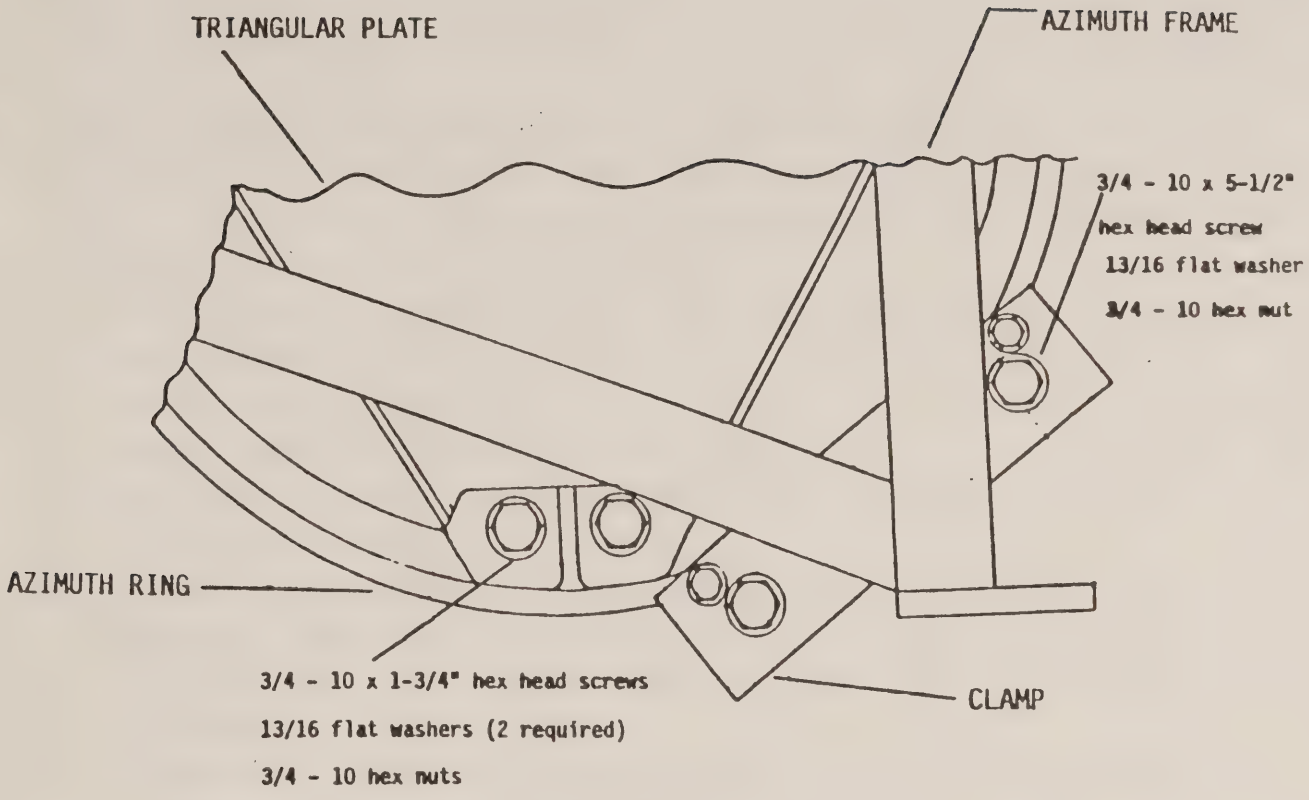
b) Insert one bearing backing plate into each of the four adjustment holes on the clamps.

c) Insert one bearing pad into each of the four adjustment holes on the clamps. Place a piece of masking tape over the pad and plate to prevent them from falling out. The tape will come off when azimuth adjustments are made.

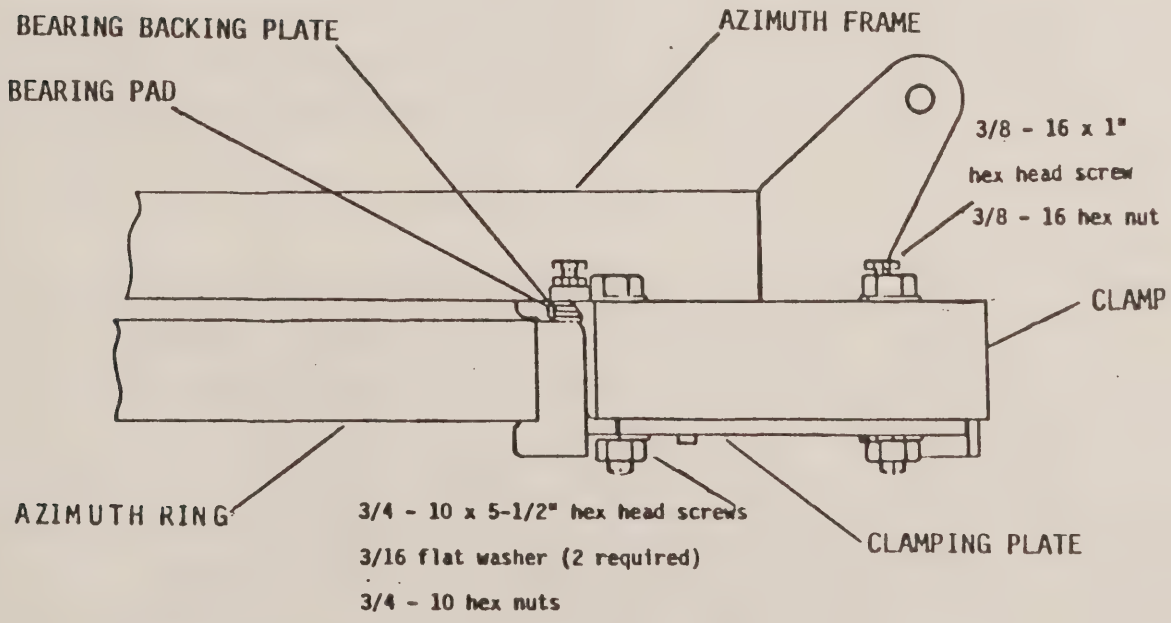
d) Attach one hex nut (3/8-16) to each of the six hex head screws (3/8-16x1").

e) Insert one hex screw/hex nut assembly into each of the four holes on the frame clamps (the remaining two hex screw/hex nut assemblies will be used on the rear azimuth clamp assembly).

f) Place the azimuth frame assembly onto the azimuth ring so that the azimuth ring fits into each clamp. Loosen the clamping plate hardware as necessary. Hand tighten this hardware after the azimuth frame assembly is attached to the azimuth ring.


TRIANGULAR PLATE
AZIMUTH FRAME
3/4 - 10 x 5-1/2" hex head screw
13/16 flat washer
3/4 - 10 hex nut
AZIMUTH RING
3/4 - 10 x 1-3/4" hex head screws
13/16 flat washers (2 required)
3/4 - 10 hex nuts
CLAMP

Top View



Side View

Figure 2-4. Azimuth Frame Assembly

2. REAR AZIMUTH CLAMPS AND ELEVATION JACK INSTALLATION. The elevation jack fits between the two rear azimuth clamps. This assembly is inserted between the rear azimuth brackets on the azimuth frame assembly. Using Figure 2-5, assemble and install as follows:

a) Attach one rear azimuth clamp to the pivot block on the elevation jack as shown in Figure 2-5. The pivot block fits through the opening on the side of the rear azimuth clamp.

b) Repeat step a for the other rear azimuth clamp.

c) Insert one greased bearing backing plate into the top hole on each rear azimuth clamp extension.

d) Insert one greased bearing pad into the top hole on each rear azimuth clamp extension. Place a piece of masking tape over the pad and plate to prevent them from falling out. The tape will come off when azimuth adjustments are made.

e) Position the assembled rear azimuth clamps and elevation jack between the rear azimuth brackets on the azimuth frame assembly.

f) Align the three holes on each rear azimuth clamp with the three holes on each rear azimuth bracket on the azimuth frame assembly.

g) Attach each rear azimuth clamp using three hex head screws (3/4-10x2¼"), six flat washers (13/16 I.D.) and three hex nuts (3/4-10). Push up on the elevation jack while installing hardware. Hand tighten hardware.

NOTE

HEX NUTS MUST BE ON THE OUTSIDE OF THE AZIMUTH FRAME BRACKETS TO ALLOW CLEARANCE FOR THE ELEVATION JACK.

NOTE

THE HARDWARE IN STEP G MUST BE HAND TIGHTENED ONLY TO PREVENT DAMAGING THE ELEVATION JACK. THIS HARDWARE WILL BE TIGHTENED ONLY AFTER INITIAL ELEVATION SETTING IS MADE.

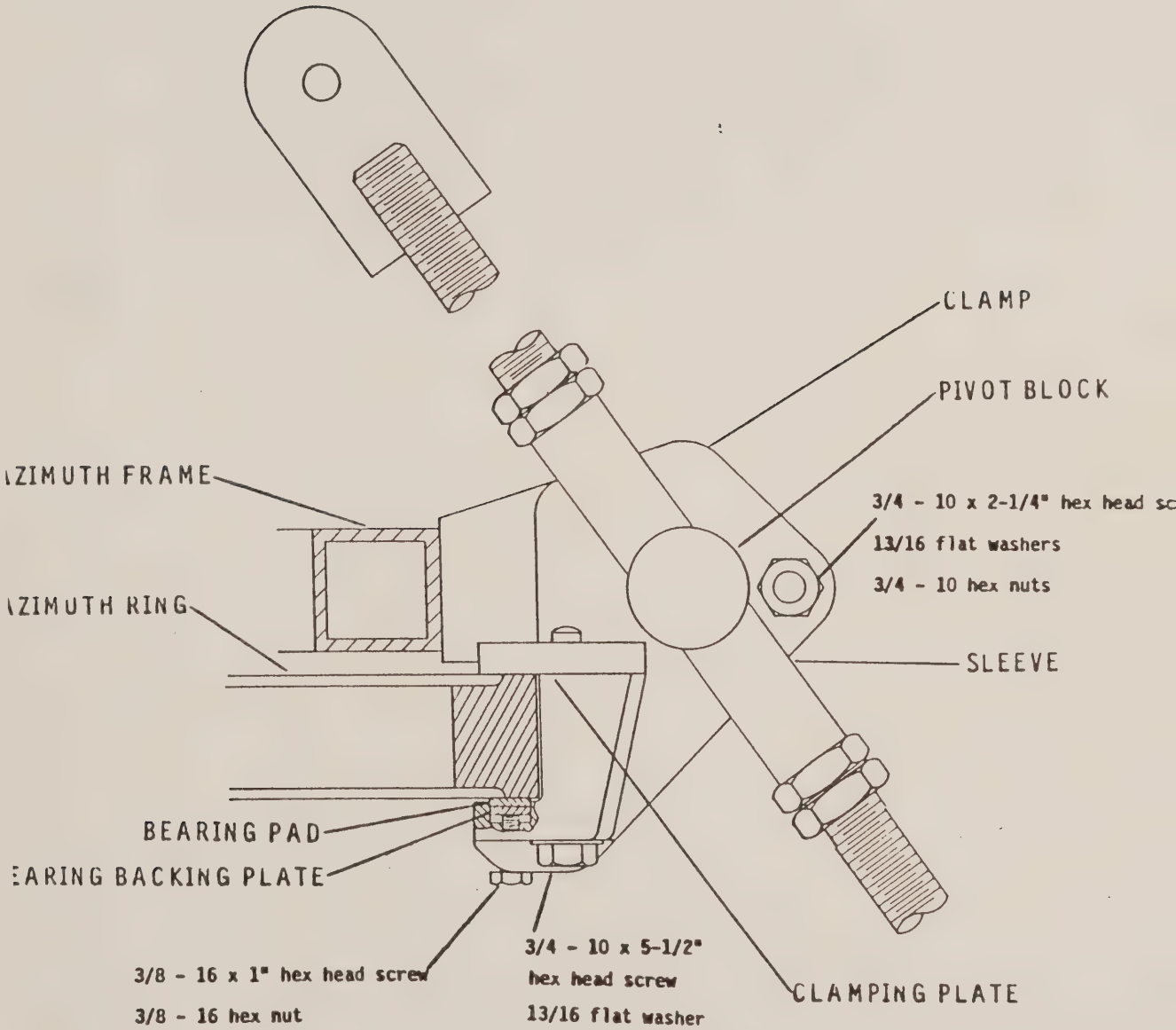


Figure 2-5. Elevation Jack and Rear Azimuth Clamps

h) Insert one hex screw/hex nut assembly (prepared in Paragraph 2-11) into the hole on the lower extension of each rear azimuth clamp.

i) Align the holes on the azimuth clamping plate with the holes on top of the rear azimuth clamps.

j) Attach azimuth clamping plate to rear azimuth clamps. Insert hardware from the bottom of the rear azimuth clamps using two each hex head screws (3/4-10x5½") and flat washers (13/16 I.D.). Tighten hardware.

k) Apply a light coating of grease to the elevation jack, pivot block and exposed threads on the azimuth clamps. Also, grease the holes on the azimuth frame brackets and elevation jack clevis.

SECTION III
REFLECTOR ASSEMBLY

2-13. INSTALLATION PROCEDURES. Assembly and installation of the reflector involves performing the following steps:

NOTE

THE REFLECTOR CAN BE ASSEMBLED DIRECTLY TO THE MOUNT OR ON THE GROUND. FOR GROUND ASSEMBLY, A CRANE MUST BE USED TO LIFT THE REFLECTOR. IF ASSEMBLING THE REFLECTOR DIRECTLY TO THE MOUNT, PROPER SCAFFOLDING MUST BE PROVIDED.

a) Lower Plate Assembly Positioning
b) Truss Angle Installation
c) Initial Truss Installation
d) Upper Plate Installation
e) Final Truss Attachment
f) Panel Installation
g) Periphery Ring and Feed Spar Bracket Installation
h) Hardware Tightening
i) U-Clip Installation
j) Intercostal Installation
k) Reflector Installation
l) Vertex Plate Installation

NOTE

AFTER REFLECTOR IS INSTALLED, REMOVE ANY GREASE, FOOTMARKS, ETC. FROM THE REFLECTOR AND SUPPORT STRUCTURE. USE A COMMERCIAL GRADE CLEANSER SUCH AS FORMULA 409.

2-14. LOWER PLATE ASSEMBLY POSITIONING. The lower plate assembly consists of three elevation clevises attached to the bottom side of the lower plate, eight channels, and a smaller middle plate attached to the channels (See Figure 2-6). For ground assembly, support the lower plate assembly at least one foot above the ground prior to assembling the reflector. This allows clearance for the clevises and for inserting truss hardware through the lower plate.

NOTE

ENSURE THAT SUPPORTS UNDER THE PLATE DO NOT OBSTRUCT SCREW HOLES OR CLEVISES AND THAT CLEARANCE IS AVAILABLE TO INSERT HARDWARE.

SUPPORTS MUST SUSTAIN THE WEIGHT OF THE REFLECTOR (APPROXIMATELY 1,000 LBS).

If assembling the reflector directly to the mount, see Paragraph 2-24 (steps **f**, **g** and **h**) for the procedures required to attach the lower plate assembly to the mount. Do not insert the pivot pin through the elevation jack/clevis connection.

2-15. TRUSS ANGLE INSTALLATION. Each of the 40 angles must be attached to the trusses. The upper angles (15") are installed on all 24 trusses. The lower angles (20") are installed on 16 of the trusses (the other eight trusses will be attached directly to the channels on the lower plate). Figure 2-6 shows a truss attached to the center plates. Proceed as follows for all truss angles:

a) Place the angle to the flat side of the truss (opposite of the stiffener flange) so that the three holes on the angle are aligned with the three holes on the truss side.

b) Attach the angle to the truss so that the hex nut is located on the side of the truss with the stiffener flange. At each location use one hex head screw (5/16-18x7/8"), two flat washers (11/32 I.D.) and one hex nut (5/16-18). Tighten hardware.

c) Repeat steps **a** and **b** for all angles.

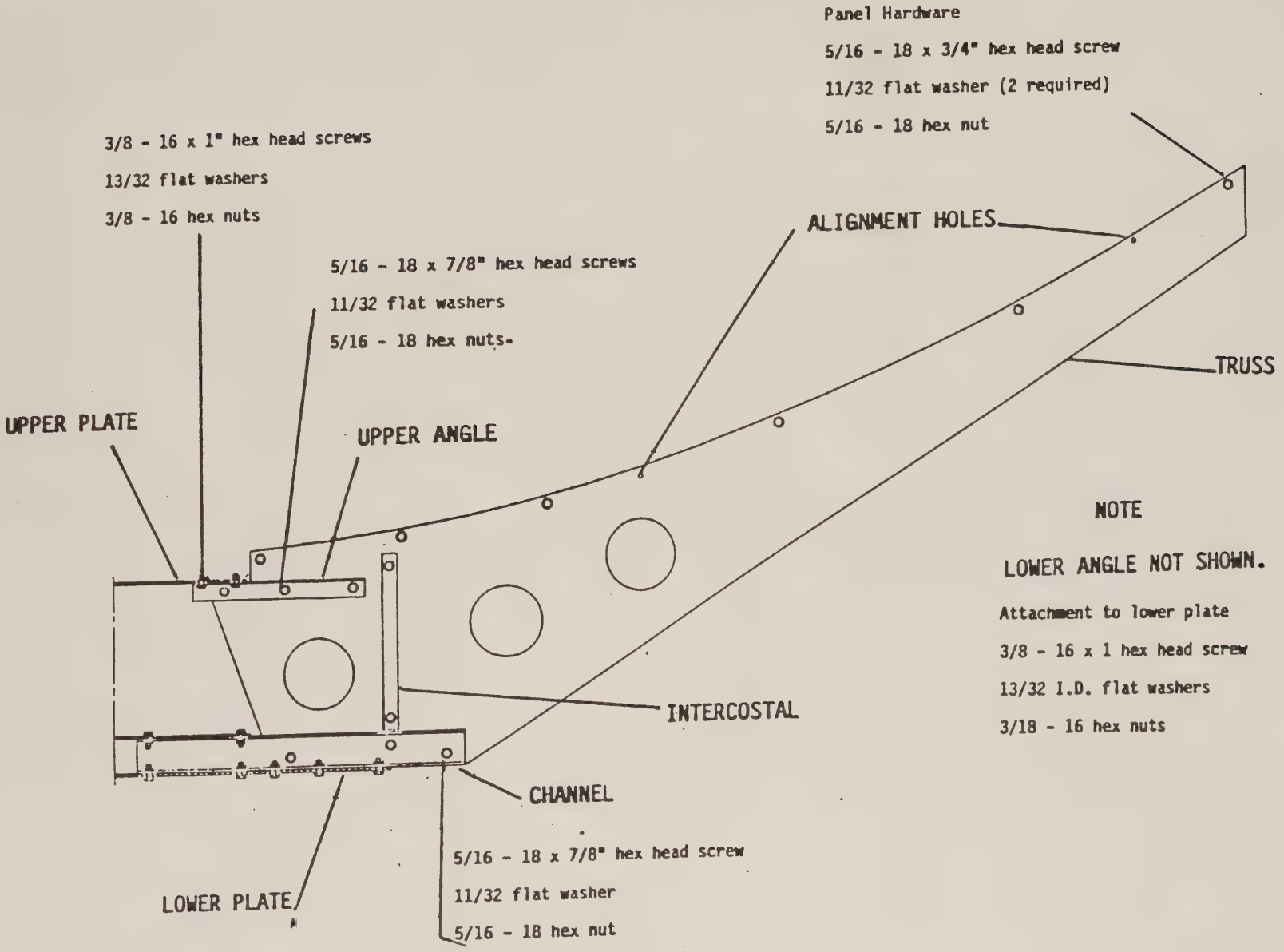

Panel Hardware
5/16 - 18 x 3/4" hex head screw
11/32 flat washer (2 required)
5/16 - 18 hex nut
3/8 - 16 x 1" hex head screws
13/32 flat washers
3/8 - 16 hex nuts
5/16 - 18 x 7/8" hex head screws
11/32 flat washers
5/16 - 18 hex nuts.
ALIGNMENT HOLES
TRUSS
UPPER PLATE
UPPER ANGLE
NOTE
LOWER ANGLE NOT SHOWN.
Attachment to lower plate
3/8 - 16 x 1 hex head screw
13/32 I.D. flat washers
3/18 - 16 hex nuts
INTERCOSTAL
CHANNEL
5/16 - 18 x 7/8" hex head screw
11/32 flat washer
5/16 - 18 hex nut
LOWER PLATE

Figure 2-6. Center Plates and Truss

2-16. INITIAL TRUSS INSTALLATION. Each of the eight trusses without lower truss angles are attached to the eight channels on the lower plate assembly. Using Figure 2-6, install as follows:

a) Align the three holes on the lower part of the truss with the three holes on the right side of the channel (as viewed facing the lower plate assembly).

b) Attach the truss to the channel so that the hex nuts are on the side of the truss with the stiffener flange. Use three hex head screws (5/16-18x7/8"), six flat washers (11/32 I.D.) and three hex nuts (5/16-18). Tighten hardware.

c) Repeat steps a and b for all eight trusses without lower truss angles.

2-17. UPPER PLATE INSTALLATION. The upper plate is attached to each of the eight previously installed trusses (See Figure 2-6). Install as follows:

NOTE

THE LETTER "T" STAMPED ON THE UPPER PLATE DESIGNATES THE TOP SIDE.

a) Attach one eyebolt (not supplied) to each of the three inner holes on the upper plate. Ensure that the eyebolt ring is on the top side of the upper plate.

b) Align two holes (in a row) on the upper plate with the two holes on each upper truss angle.

c) Attach the upper plate to the truss so that the hex nuts are on the top side of the upper plate. Use two hex head screws (3/8-16x1"), four flat washers (13/32 I.D.) and two hex nuts (3/8-16). Do not tighten hardware.

NOTE

INSERT INNER HARDWARE FIRST TO PERMIT EASIER INSTALLATION OF THE OUTER HARDWARE.

d) Repeat steps a and b until the upper plate is attached to all 8 trusses.

2-18. FINAL TRUSS ATTACHMENT. With the upper plate installed, the remaining 16 trusses can be installed. Proceed as follows:

a) Align the two holes on the lower truss angle with the two holes (in a row) on the lower plate.

b) Attach the truss to the lower plate so that the hex nuts are on the top side of the lower plate. Use two hex head screws (3/8-16x1"), four flat washers (13/32 I.D.) and two hex nuts (3/8-16). Do not tighten hardware.

c) Repeat steps **a** and **b** for truss attachment to the upper plate.

NOTE

INSERT INNER HARDWARE FIRST TO PERMIT EASIER INSTALLATION OF THE OUTER HARDWARE.

d) Repeat steps **a, b** and **c** for all 16 trusses.

e) With all trusses installed, tighten the hardware between the 16 trusses and the lower plate. Tighten all the inner hardware in a circular pattern before moving to the outer set of hardware. Do not tighten hardware on the upper plate.

2-19. PANEL INSTALLATION. The reflector consists of 24 panels supported by the trusses. Install as follows:

a) Place one panel to the upper plate ('V' end in) so that it fits between two trusses.

b) Align the holes on the left side of the panel with the holes on the adjacent truss.

c) Temporarily support the panel's left side by inserting hardware through the panel-to-truss connection near the outer panel edge. Use one each hex head screw (5/16-18x7/8") and hex nut (5/16-18). Hand tighten.

d) Place one panel to the right of the previously installed panel so that a truss is between the two panels.

e) Align the holes on the left panel side with the holes on the truss and the previously installed panel. Insert the alignment tool through the alignment holes to help line-up the panels.

NOTE

INSERT HARDWARE THROUGH THE HOLES SHOWN IN FIGURE 2-6. THE TWO ALIGNMENT HOLES CAN BE USED TO ALIGN THE PANEL SIDES.

f) Attach panels to truss. Insert one hex head screw (5/16-18x3/4") with flat washer (11/32 I.D.) from left to right through each aligned hole on the panels and truss. As shown in figure 2-6, do not insert hardware through the alignment holes. Attach one flat washer (11/32 I.D.) and hex nut (5/16-18) to the screw. Do not tighten hardware.

g) Repeat steps **d**, **e** and **f** for the next adjoining panels until all panels are installed

NOTE
TO INSTALL THE LAST PANEL, REMOVE THE TEMPORARY SUPPORT HARDWARE INSTALLED IN STEP C.

2-20. PERIPHERY RING INSTALLION. The periphery rings attach to the outer edge of the reflector. Installs as follows:

a) Place a periphery ring to the reflector edge so that the middle holes on the periphery ring are aligned with the holes on the truss end

b) Attach using two hex head scows (3/8-16x1"), four flat washers and two hex nuts (3/8-16). Do not tighten hardware.

c) Place a periphery ring so that the holes on one end (without the plate) fit under the plate of the previously installed periphery ring.

d) Attach using two hex head scows (3/8-16x1"), four flat washers (13/32 I.D.) and two hex nuts (3/8-16). Do not tighten hardware.

e) Repeat steps A - D for the remaining periphery rings.

f) Insert hardware at the remaining middle holes on the periphery ring. Use two hex head scows (3/8-16x1"), four flat washers (13/32 I.D.) and two hex nuts (3/8-16). Do not tighten hardware.

2-21. HARDWARE TIGHTENING. Tighten the panel-to-panel connection and the periphery rings as follows:

a) Tighten all panel-to-panel hardware in the first panel holes nearest the upper plate before moving outward to the next series holes. Continue working in a circular pattern around the reflector until all panel-to-panel hardware is tightened.

b) Tighten the bolts on the periphery ring while pushing up on the periphery ring (this is to align the edge of the periphery ring to the panel edge). Work in a circular pattern around the edge of the reflector.

2-22 U-CLIP INSTALLATION. The panel skins are clamped to the periphery ring around the reflectors edge with U-clips. Install as follows:

a) Attach one U-clip over the edge of the periphery ring and the panel edge at each seam where two panels meet. Ensure that the two-pronged side of the U-clip fits over the periphery ring.

b) Attach two U-clips over the edge of the periphery ring and the panel edge a two equally spaced points on each panel. Ensure that the two-pronged side of the U-clip fits over the periphery ring.

NOTE

DOE TO THE LIMITED SUPPLY
OF U-CLIPS THAY MY BE REPLACED WITH
SELF-DRILLING SCREWS. A POWER SCREWDRIVER OR A DRILL IS REQUIRED TO INSERT THE SELF-DRILLING SCREWS.

2-23 INTERCOSTAL INSTALLATION. The 24 intercostals are attached between the trusses to enhance reflector stability (See Figure 2-6). Each adjacent pair of intercostals has one set of hardware in common (at two location). Install as follows:

a) With intercostal flange facing outward away from the center plate, align the intercostal holes with the holes on the side of the truss.

b) As viewed facing the center plate, insert hardware (on the right side only) through the intercostal and the truss holes from left to right. Use two hex head screws (5/16-18x7/8") and two flat washers (11/32 I.D.).

c) Insert a intercostal to the right of the previously installed intercostal. Align intercostal over the hardware installed in step **b**.
installed hardware on the left side of the intercostal. Tighten hardware.

e) Repeat steps **b**,**c** and **d** for all intercostals.

f) Tighten the hardware on the upper plate. tighten all of the inner hardware in a circular pattern before tightening the outer hardware.

2-24. REFLECTOR INSTALLATION. The assembled reflector must be hoisted by the crane and attached to the mount as follows (for ground assembly only):

NOTE

ENSURE THAT THE ELEVATION JACK ON THE MOUNT IS ADJUSTED DOWNWARD TO ITS LOWEST LIMIT.

a) Position the crane.

b) Attach slings to the eyebolts on the upper plate.

WARNING

1. CREW MEMBERS MUST KEEP CLEAR OF SWINGING REFLECTOR.
2. KEEP FINGERS CLEAR WHEN POSITIONING REFLECTOR.

c) Lift the reflector off the ground.

d) Loosen slightly the two front pivot clevises on the lower plate. This simplifies aligning the elevation clevises onto the pivot brackets on the mount.

e) Hoist the reflector onto the mount.

f) Position the elevation clevises (on the underside of the lower plate) onto the front pivot brackets and the elevation jack clevis. Align holes.

NOTE

WHEN BUILDING THE REFLECTOR ON THE MOUNT, DO NOT INSERT THE PIVOT PIN THROUGH THE ELEVATION JACK/CLEVIS CONNECTION. THE ELEVATION JACK CAN BE PUSHED AWAY FROM THE MOUNT TO PERMIT TURNING THE AZIMUTH RING FOR EASIER INSTALLATION.

g) Insert one pivot pin through each of the elevation clevises.

h) Attach the retaining rings to the pivot pins.

i) Tighten the hardware on the pivot clevises.

j) Remove slings.

2-25. VERTEX PLATE INSTALLATION. The vertex plate is attached to the panel extensions at the center of the reflector. Install as follows:

NOTE

A POWER SCREWDRIVER OR DRILL IS REQUIRED TO INSERT THE SELF-DRILLING SCREWS.

a) Remove the eyebolts from the upper plate.

b) Place the vertex plate into the center of the reflector with the curved side down. This slight downward bow continues the "bowl" shape of the reflector.

c) Align the holes on the vertex plate with the center of one angle on the panel ends. If using a drill, holes can be bored at each location. Attach using twelve self-drilling hex head screws (TEKS/3).